zones of *Gryphaea vesicularis*, *Radiolites*, *Ostrea acutirostris*, &c., are noted. Economic geology rightly received considerable attention, and the mineral Mica was selected for special study. Records are also given of the important work done in the Laboratory and in the Palæontological Department.

THE fourth edition of "Remarkable Eclipses," by Mr. W. T. Lynn, has just been published by Mr. Edward Stanford. Reference is made to the results of observations of the Indian eclipse last year, and to the eclipse which will occur on May 28, 1900. The central line of this eclipse will pass from America across Portugal, Spain and Algeria.

THE tenth annual report of the Missouri Botanical Garden has recently been published. Dr. W. Trelease, the Director of the Garden, states that the collection of plants now includes more than eight thousand species and varieties, of which all but one or two hundred are named with more or less accuracy. Among the collections specially worthy of mention are the cacti, of which 462 species are cultivated; the orchids, represented by 548 named forms; the aroids, of which there are 274 species in the collection; the ferns, including 169 species; and palms, 61 species; while of hardy trees and shrubs there are 1811 species and varieties; of hardy herbaceous plants, 2179; and of vegetables, 1016. Roughly divided, the collection includes 5000 hardy forms, and 3000 cultivated under glass. The Herbarium comprises 307,460 specimens. Two scientific papers are included in the present report: one on the grasses in the Bernhardi Herbarium in the Missouri Botanical Garden, and another on a sclerotioid disease of beech roots. There is also a biographical sketch, by Prof. C. S. Plumb, referring to the late Dr. E. Lewis Sturtevant, whose gift of his extensive and valuable library of pre-Linnean works was an event in the history of the Garden; and a list of publications issued from the Garden in 1897 and 1898.

THE additions to the Zoological Society's Gardens during the past week include a Serval (*Felis serval*) from Africa, presented by Sir R. B. Llewellyn, K.C.M.G.; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. T. Mark Merriman; a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. J. M. Skinner; a Spotted Ichneumon (*Herpestes auro-punctatus*) from Nepal, presented by Miss Jackson; a Red-faced Onakari (*Onacaria rubicunda*) from the Upper Amazons, a Red-vented Cockatoo (*Cacatua hoematuropygia*) from the Philippine Islands, deposited; two Lion Marmosets (*Midas rosalia*) from South-east Brazil, four Violet Tanagers (*Euphonia violacea*), three Blue-shouldered Tanagers (*Tanagra cyanoptera*), a Black-headed Sugar Bird (*Chlorophanes viridis*) from Brazil, a Black-necked Swan (*Cygnus nigricollis*) from Antarctic America, purchased.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN SEPTEMBER:—

September 4. 19h. Mercury at greatest elongation (18° 2′ W.).
9. 7h. Jupiter in conjunction with moon (☽ 4° 51′ N.).
12. 6h. Saturn in conjunction with moon (♄ 1° 55′ N.).
12. 8h. 47m. to 9h. 26m. Occultation of 39 Ophiuchi (mag. 6·0) by the moon.
13. 5h. 5m. to 6h. 9m. Occultation of 1 Sagittarii (mag. 5·3) by the moon.
14. 11h. 47m. Minimum of Algol (β Persei).
15. Mars. Illuminated portion of disc 0·967.
17. 8h. 36m. Minimum of Algol (β Persei).
19. 6h. 25m. Transit (ingress) of Jupiter's Sat. III.
23. 15h. 29m. to 16h. 25m. Occultation of A^1 Tauri (mag. 4·5) by the moon.

HOLMES' COMET 1899 *d* (1892 III.).—

Ephemeris for 12h. Greenwich Mean Time.

1899.	R.A.	Decl.	Br.	
			r^{-2}	$(r\Delta)^{-2}$
	h. m. s.	° ′ ″		
August 31	3 2 59·26	+40 1 26·8		
Sept. 1	3 37·68	40 16 1·8	0·1851	0·05219
2	4 14·34	40 30 31·8		
3	4 49·22	40 44 56·5		
4	5 22·26	40 59 16·0		
5	5 53·46	41 13 29 8	0·1833	0·05328
6	6 22·76	41 27 37·9		
7	3 6 50·14	+41 41 40 0		

SPECTRA OF RED STARS (SECCHI'S TYPE IV.).—In the *Astrophysical Journal*, vol. x. pp. 87–112, Messrs. G. E. Hale and F. Ellerman contribute the first of a proposed series of papers describing the additional work they have done on these stars since the first investigations in January 1898. The photographs have been obtained with the Yerkes 40-inch lens, which being corrected only for the visual rays, somewhat limited the region of spectrum available, until a correcting lens was obtained. This consists of a compound lens of 32 mm. aperture, supported in the cone of rays from the 40-inch objective at a distance of about 30 cm. from the slit of the spectroscope. The introduction of this lens decreases the focal length of the objective for light of λ 4500 by about 60 mm., but at the same time it so alters the original steepness of the colour-curve that it is found possible to photograph a much larger extent of spectrum at the same time.

The spectroscope originally used has been considerably modified. The collimator lens has an aperture of 31 mm. and focus of 507 mm. Three prisms of dense flint ($\mu = 1{\cdot}696$) are available, and for most of the work it has been found best to use a short camera, aperture of lens (a photographic doublet) being 37 mm. and its focal length 271 mm.

The width of the photographed spectra is usually about 0·18 mm.; the scale of the negatives is such that

at λ 4400, 1 mm. = 18·5 tenth metres;
,, λ 5350, 1 mm. = 49·6 tenth metres.

The authors proceed to describe in minute detail their methods of measurement and reduction, introducing a very ingenious *interpolating* machine they have devised to draw the reduction curves as accurately as possible.

Several illustrations accompany the article, showing the breech-piece of the 40-inch with various spectroscopes in position, two views of the interpolating machine, and a reproduction of the spectrum of 152 Schjellerup extending from λ 4800 to λ 6300. With respect to the latter, attention is drawn to the apparent bright line at λ 5592. The authors find it is easily photographed with *four minutes'* exposure, while to obtain the continuous spectrum adjoining of equal density takes from 12 to 15 minutes. This they think is in favour of its being a true bright line. From its appearance, they think it probable that whatever substance produces this line must exist in the star's atmosphere at a level *above* that of the carbon or hydrocarbon vapour which produces the heavy absorption-bands.

PHOTOMETRY OF THE PLEIADES.—Herren G. Müller and P. Kempf, of the Potsdam Observatory, have been investigating the brightness of the component stars of the Pleiades group, and the greater part of *Astr. Nach.* (Bd. 150, Nos. 3587–8) is devoted to their communication. They begin by giving tables showing the values obtained for the magnitudes of the principal stars by previous authorities, including Lindeman, Pickering, and Pritchard, and also an analysis of these values showing the varying discrepancies between the several measures of the same star. Then follows an account of their work of determining the magnitudes of 96 stars of the group, the instrument used being a Zöllner photometer in conjunction with telescopes of varying apertures. Full details are given of the preliminary experiments made for determining the constants of the instruments, &c., using certain of the stars as standards.

THE SYSTEM OF SIRIUS.—In the *Astr. Nach.* (Bd 150, No. 3588), Herr H. J. Zwiers, of Leiden, gives a revision of his previously calculated elements for the Sirius system (*Astr. Nach.*, No. 3336), which he has been enabled to make by employing the recent measures of Messrs. Aitken and Hussey,

made at Mount Hamilton during 1898 and 1899. The elements he gives are the following :—

System II.

T = 1894·0900	$i = 46° 1'·9$
$\mu = -7°·37069$	$\Omega = 44° 30'·2$ (1900)
P = 48·8421 years	$\pi - \Omega = 212° 6'·4$
$e = 0·5875$	

The mean value of the distance of the companion is given as

$$a = 7''·594.$$

CATALOGUE OF ASTRONOMICAL INSTRUMENTS.—Sir Howard Grubb has sent us a revised edition of his catalogue of astronomical instruments, observatories, &c., showing the nature of the work turned out from his workshops at Rathmines, Dublin. The quality and performance of these are well known to practical astronomers. The catalogue in its new form will be interesting to all from the beautiful illustrations with which it is furnished, showing in a most convincing manner the capabilities of various optical and mechanical contrivances. The frontispiece is a reproduction of a photograph of η Argus taken with the astrographic telescope at the Cape Observatory. At the end of the volume there are four plates showing "The solar eclipse of 1898," "A specimen of work done by a photographic doublet of 15 inches aperture," "The great nebula in Orion," and "The Dumb-bell nebula in Vulpecula"; the two latter being from negatives taken by Mr. W. E. Wilson with a reflector of 24 inches aperture.

THE CAPE OBSERVATORY.

THE annual report of Her Majesty's Astronomer at the Royal Observatory, Cape of Good Hope, for the year 1898, has recently been published. The following is a short *résumé* of the chief details :—

The McClean Telescope.—The equatorial mounting of this instrument, the generous gift of Mr. F. McClean, F.R.S., reached Table Bay in good order on April 11, 1898. In six weeks all the parts had been mounted and adjusted, the stand, however, requiring considerable modification. The fittings for electrical illumination of the circles, scales, and micrometers had to be made or remodelled at the Cape.

The hydraulic motor for rotating the dome arrived on July 4, the hydraulic ram and valves for automatic clock-winding on October 11, and by November 1 all the essentials of the observatory and stand were fitted and in good working order. The raising and lowering of the floor and rotation of the dome are commanded by cords which may be actuated by the observer at the eye-end of the telescope with the utmost ease and delicacy, while the hydraulic clock-winding gear, contrived by Mr. McClean, automatically winds up the clock-weight at short intervals without communicating the slightest vibration to the telescope.

The 18-inch visual object-glass has proved to be a very fine one, both its spherical and chromatic corrections being practically perfect, as far as the kinds of flint and crown glass at present procurable in discs of that size will allow.

The 24-inch glass has two faults : the marginal images show well-marked *coma*, and the minimum focus, instead of being near to or more refrangible than $H\gamma$, is for rays of refrangibility between $H\beta$ and $H\gamma$. It is understood that Sir Howard Grubb will remedy these defects. The slit spectroscope for line of sight work, made by the Cambridge Scientific Instrument Company, was shipped from London on December 21, and the 24-inch glass cannot be returned for alteration until tests have been made with this spectroscope in conjunction with it.

The New Transit Circle.—The foundations for the new transit circle have been built, and the observatory, of sheet steel, is constantly expected from Messrs. T. Cooke and Sons, of York. Messrs. Troughton and Simms reported that the transit circle itself would probably be ready in March 1899.

Astronomical Observations.—The work of the *transit circle* has been chiefly devoted to observations of standard stars for reduction of the measures of the "Catalogue Photographic Plates." During the year 10,355 meridian transits and 9863 determinations of zenith distance have been recorded.

With the *Heliometer* systematic observations of the major exterior planets have been made, the year's work including fifty-three measures of Jupiter, forty-four of Saturn, forty-five of Uranus, and seventy-two of Neptune, all during opposition. This instrument has also been employed in the triangulation of twenty-one stars surrounding the South Pole, and for investigation the possibility, first suggested by Dr. Rambaut, of atmospheric chromatic dispersion affecting the accuracy of heliometer observations. The *seven-inch equatorial* has been employed for observations of occultations, revision of star-lists, and Coddington's comet; and the *six-inch telescope*, in conjunction with a Zöllner photometer, for the comparison of photographic and visual magnitudes in areas near the pole and equator of the Milky Way.

With the astrographic telescope, 469 plates have been obtained, 200 of these being "revision plates," as it is proposed to repeat the whole series of catalogue plates, in order to bring the epoch at which the plates were taken nearer to that at which the comparison stars were observed on the meridian.

Geodetic Survey of South Africa.—The field operations in connection with the geodetic survey of Rhodesia were resumed in May at the close of the rainy season, the early part of the year having been spent in training the observers in the use of the Jäderin base-measuring apparatus, the constants of which were accurately compared with the Cape measuring bars. The difference of longitude between Buluwayo and the Cape Observatory was determined by exchange of telegraphic signals on four nights, the astronomical latitude and azimuth being also observed. After the selection of a site, a base line of $11\frac{3}{4}$ miles in length was measured, and during the year seventeen stations were occupied and measurements taken therefrom.

An arrangement for the delimitation of the Anglo-German boundary between British Bechuanaland and German South-west Africa having been approved by both Governments on January 1, Lieutenant Wettstein and Major Laffan, R.E., after some months' sojourn at the observatory for practice in astronomical observations, commenced operations at Reitfontein (long. 20° E., lat. 26° 47′ S.) on November 19, by determinations of astronomical latitude and azimuth and the selection of stations.

The existing triangulation in the Cape Colony on the meridian of 20° E. long. is at present limited to the northern triangles of Sir Thomas Maclear's arc and to Bosman's accurate triangulation of Bechuanaland from Vryburg to the 20th meridian, and along that meridian from the Orange River to Reitfontein. There thus remains to complete the chain from Cape Agulhas (the southern point of Africa) to Reitfontein, a distance of only 140 miles to be filled in. The triangles for this work have been selected, and are about to be measured with the Repsold theodolite by Mr. Alston.

In connection with the survey of Rhodesia, Mr. Rhodes has promised that when he is in a position to commence the extension of the railway from Buluwayo to the Zambesi, he will place at the disposal of Her Majesty's Astronomer the funds necessary to carry on the arc of meridian from Southern Rhodesia to Lake Tanganyika. Thus there is in prospect the completion of the following valuable geodetic data :—

(1) A geodetic arc along the meridian of 20° E. long. from Cape Agulhas (lat. 34° 49′ S.) to the parallel of 22° S. lat., perhaps to 18° S. lat., *i.e.* an arc of 12° 49′, or possibly of 16° 49′ in length.

(2) An arc along the meridian of 30° E. long. from the south of Rhodesia (lat. 22° S.) to the southern extremity of Lake Tanganyika (lat. 8° 40′ S.), an arc of 13° 33′ in length. Both of these important operations will be under the direction of Her Majesty's Astronomer.

It is also hoped that the German Government will carry the latter work along the eastern border of Lake Tanganyika to Uganda, whence the way is now clear for a triangulation along the Nile to Alexandria, *i.e.* practically along the same meridian as above, 30° E. long. This latter work should for various reasons be commenced at its northern extremity.

Longitude of Lake Nyassa.—The longitude of Nkata Bay